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ADHESIVE FILM

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[There are no amendments to this patent.]

[*Translator's note: Names of products and firms are spelled phonetically in this translation.*]

Specification

1. Title of the invention

Adhesive film

2. Claim of the invention

In an adhesive film structure comprising a release film, pressure-sensitive adhesive layer, and a base material film, an adhesive film characterized by the fact that the above-mentioned release film is a synthetic resin film embossed to form continuous ribs with heights of 1 to 15 μm.

3. Detailed description of the invention

The present invention pertains to an adhesive film, and the invention further pertains to an adhesive film suitable for use in optical applications.

Adhesive films used for optical applications consist of a base material film, a pressure-sensitive adhesive layer, and a release film, and upon application, the adhesive film is cut to form the desired shape, the release film is removed and the film is applied to the target. As the aforementioned release film, in general, a synthetic resin film having a smooth surface is used, and when it is possible to apply the adhesive surface of the pressure-sensitive adhesive layer

smoothly to the object, an adhesive surface with excellent optical properties can be achieved. However, in many cases, air is trapped on the adhesive surface unless special cautions are taken upon application of the film, and removal of the air is impossible once application is completed. The present inventors conducted much research on prevention of air entrapment at the time of bonding an adhesive film to an object, and as a result, they discovered that the adhesive surface of a conventional adhesive film is too smooth and further research lead to the present invention.

Thus, the present invention is an adhesive film characterized by the fact that the above-mentioned release film is a synthetic resin film embossed to form continuous ribs with heights of 1 to 15 μm wherein the adhesive film structure comprises a release film, a pressure-sensitive adhesive layer, and a base material film.

For the release film used in the present invention, release films commonly used for the purpose can be used and those with a release surface treated with silicon are especially desirable.

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In the present invention, it is essential for the entire surface of the above-mentioned release surface to be embossed with continuous ribs having a height in the range of 1 to 15 μm, preferably, in the range of 2 to 10 μm. The above-mentioned continuous ribs and recesses are transferred to the adhesive surface of the pressure-sensitive adhesive layer (surface to be bonded with the object). When the above-mentioned recesses (grooves) are included, entrapment of air can be prevented, and removal of the entrapped air can be easily achieved. It is ineffective when the height of the above-mentioned ribs is less than 1 μm; on the other hand, when the height exceeds 15 μm, entrapment of air occurs under the adhesive surface (pressure-sensitive adhesive layer) and deformation occurs in the pressure-sensitive adhesive layer, and problems occur when the film is used for optical applications. The shape of embossing is not especially limited as long as continuous ribs are formed, and specific examples are shown in Fig. 1 through Fig. 3. The lines in the figures represent the ribs.

For the adhesive used in the present invention, the composition is not especially limited as long as the adhesive is an adhesive that is commonly used, and from the standpoint of optical properties, an acrylic type adhesive is especially suitable.

The adhesive film of the present invention is produced by coating or laminating a pressure-sensitive adhesive on the surface of a release film or base material film and pressure bonding the base material film and release film onto the surface. In this case, it is desirable when thorough drying is performed so that the heat loss becomes 1% or less, preferably, 0.5% or less, when a heat-treatment is applied at a temperature of 100°C for 2 hours to prevent air bubble formation and subsequent entrapment of air. Furthermore, the thickness varies depending on the height of the embossing, and in general, a thickness in the range of 10 to 50 μm is adequate.

Air entrapment is absent in the adhesive film of the present invention at the time of application; thus, excellent bonding of the adhesive surface can be achieved, and the film is suitable for optical applications.

For examples of base material films used in the optical field, ultraviolet blocking films, heat blocking films, color filter films, polarized films, etc. can be mentioned, and the adhesive film made of the above-mentioned films is cut according to the application and can be used for sunglasses, anti-reflective glasses, ultraviolet filters, etc. Furthermore, when a polarized film is used in combination with a liquid crystal cell, it is effective for use in liquid crystal display devices.

Furthermore, air bubble formation is absent even when the adhesive film of the present invention is exposed to high temperatures and high humidities, and the film can be used effectively.

In the following, the present invention is explained in further detail with working examples.

Reference Example 1 (production of embossed release sheet)

A commercial biaxially drawn polypropylene film (thickness of 100 μm) is used and an embossing roll having the embossing pattern shown in Fig. 1 is used and embossing was done at a temperature of approximately 80°C. Subsequently, a silicon resin type release agent was coated on the surface, and baking was done to produce release film A having a mean height of the ribs and grooves of 8 μm.

Meanwhile, a biaxially drawn polyethylene terephthalate film with a thickness of 50 μm was used and embossing was done (approximately at 120°C) so as to form an embossing pattern shown in Fig. 3, and above-mentioned silicon treatment was further carried out so as to produce release film B having a mean height of the ribs and grooves of 3 μm. In this case, a measurement was made of the height of the ribs and grooves using a tracing type surface roughness measurement instrument.

Working Example 1

An acrylic type adhesive (product of Nogawa Chemical Co., Ltd., Diabond DA-672 (registered trademark), contains 5% of curing agent) was coated onto the embossed surface of release film A using a roll coater, and drying was done for approximately 15 minutes in a drying oven set at 90°C. The coated thickness after drying was approximately 20 μ, and the loss from heat after 100°C x 2 hrs was 0.7%. A commercial polarized film (product of Sanritsu Electric Co., Ltd., Bun-Line L-82-18) was applied to the above-mentioned pressure-sensitive adhesive layer using a lamination roll under a pressure of approximately 4 Kg/cm^2 and production of an adhesive polarized film was achieved.

Subsequently, removal of the release film was carried out for the above-mentioned adhesive film, and the film was applied to a commercial liquid crystal cell (surface glass sheet) via the adhesive using a heat compression roll at 50°C. Air bubble formation was absent at the

interface and air bubble formation did not occur even after storage at 80°C for approximately 1 month.

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Working Example 2

Coating was carried out for release film B with an acrylic type pressure-sensitive adhesive (product of Nogawa Chemical Co., Ltd., Diabond DA-672 (registered trademark), contains 2% of curing agent) using a roll coater and drying was further carried out at a temperature of 120°C for approximately 10 minutes. The thickness after coating was approximately 30 μm and heating loss after 100°C x 2 hrs was 0.3%. The above-mentioned commercial polarized film was applied to the above-mentioned pressure-sensitive adhesive layer using a lamination roll under a pressure of approximately 5 Kg/cm^2 and production of an adhesive polarized film was achieved.

Subsequently, removal of the release film from the above-mentioned adhesive film was done, and the film was applied to a commercial liquid crystal cell by means of a heat compression roll, air bubble formation was absent at the interface and air bubble formation did not occur even after storage at 80°C for approximately 1 month.

Comparative Example 1

A commercial biaxially drawn PET film was used as a release film and coating of the above-mentioned pressure-sensitive adhesive was done for the smooth surface. Drying was further provided, and lamination of the above-mentioned polarized film was done as described above to produce an adhesive polarized film.

When removal of the release film from the above-mentioned adhesive film was done and application to a liquid crystal cell was done as described above, many air bubbles were observed on the adhesive surface. Furthermore, a clear image was not obtained when said film was applied to a liquid crystal display device.

4. Brief description of figures

Fig. 1 through Fig. 3 are partial enlargement views of examples of the embossing of the release film. Lines shown in the figs represent ribs.

Applicant: Mitsui Toatsu Chemical Co., Ltd.

Fig. 1

Fig. 2

Fig. 3